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Analysis of Physicochemical Properties and Volatile Compound of Black Sapote Wine Produced with *Saccharomyces cerevisiae* Yeast

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ABSTRACT

This study aimed to develop black sapote wine and alayze its physicochemical properties and volatile compounds. The wine was produced by fermentation using *Saccharomyces cerevisiae* yeast at different concentrations (0%, 0.5%, and 1%) for seven days. Physicochemical analysis showed pH values of 4.35%, 3.56%, and 3.83%, and titratable acidity values of 0.09%, 0.25%, and 0.2%. Gas Chromatography-Mass Spectrometry (GC-MS) analysis identified several volatile compounds, including alcohols, organic acids, alkanes, and esters. The alcohol group comprised of 20.28%, 61.57% and 34.54%, organic acids 25.5%,14.2%, 20.94%, alkanes 0.69%, 4.44%, 30.61% and esters 2.19%, 12.67%, 6.64% respectively. Fermentation in the production process of black sapote wine has been successful based on its acidity and volatile compound profile.

Keywords: black sapote, gas chromatography, physicochemical analysis, wine

INTRODUCTION

The black sapote fruit is an undervalued fruit in Indonesia despite its high nutritional value. It is rich in vitamins C and E, potassium, and calcium. However, it is not widely known among Indonesian people and its perishable nature makes distribution and storage a challenge. Fermenting it into alcoholic beverages is one of the possible methods to increase its value and shelf life. Optimization of fruit wine production involves factors such as sugar concentrations, fermentation time and temperature, pH, yeast strain, and inoculum concentration. Studies have shown that yeast inoculum concentration affects the fermentation rate and wine profiles. Finding the optimal inoculum concentration is critical to producing optimal fruit wine. Currently, there are no studies on black sapote wine production, so investigating the effect of *Saccharomyce*s *cerevisiae* concentration on wine quality is important to determine its potential and profiles.

METHODS

Black sapote was obtained from PT INAGRO, Bogor, West Java, Indonesia. Fermentation was performed using commercial yeast *Saccharomyces cerevisiae* Lalvin EC-1118 (Lallemand Inc., Canada). Total soluble solids (TSS) were analyzed using a refractometer (Master-53, Atago Co., Ltd., Japan). The potential of hydrogen (pH) was measured by using a calibrated pH meter (pH Spear, Eutch Instruments Oakton, England). Titratable acidity was used to determine the acid concentration in fruit and wine samples. One gram of each sample was mixed with 30 mL water and phenolphthalein. Titrated with 0.1N NaOH until the color changed. The acidity was expressed as citric acid. Physicochemical analysis was performed in triplicate. The GC analysis was performed using an Agilent GC system with a DB-5MS UI 5% phenyl methyl siloxane column. The temperature range was 0 to 325°C, with a one-minute hold at 40°C and a post-run temperature of 300°C. A 1 µLsample volume was injected after derivatization with N, O-bistrifluoroacetamide (BSTFA).

RESULTS AND DISCUSSION

In Table 1, the pH of the sample with 0% concentration of *Saccharomyces cerevisiae* showed a slight decrease from 4.64±0.30

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Table 1. pH and titratable acidity of black sapote wine on day 7

Sample (%)	pH	Titratable acidity (% citric acid)
0	4.35±0.34[a]	0.09±0.03[a]
0.5	3.56±0.09[b]	0.25±0.12[b]
1	3.83±0.04[b]	0.20±0.04[b]

to 4.35±0.34 over seven days, probably due to oxidation and microbial contamination. The sample with the 0.5% concentration of *Saccharomyces cerevisiae* showed a significant decrease in the pH value from 4.33±0.02 to 3.56±0.09 on day 7. The pH of the sample with 1% concentration of *Saccharomyces cerevisiae* decreased from 4.34±0.03 to 3.83±0.04 on day 7, influenced by yeast fermentation and acid production. Lower pH values (±3.02) are preferable for polyphenol stability, as higher pH can lead to auto-oxidation (Panda *et al.* 2014).

The titratable acidity of the sample with 0% yeast concentration showed no significant change over time. The samples with 0.5% and 1% concentration increased from 0.06±0.02% to 0.25±0.12% and 0.20±0.04, respectively, by the end of fermentation. The accumulation of organic acids indicates successful fermentation, provides fresh flavor, and inhibits spoilage bacteria (Ahmed *et al.* 2017).

As seen in Figure 1, the result showed the presence of various compounds in the sample with 0% concentration of yeast, such as 3 8-dioxa-2 9-disiladecan-5-one, arabinofuranose, and d-mannose. 3 8-Dioxa-2 9-disiladecan-5-one was the most abundant with 40.47%. In the sample with 0.5% concentration of yeast, volatile compounds were identified as alcohol (61.57%) and acid (14.20%), with neopentyl alcohol and doconexent being the most abundant, respectively. In the sample with 1% yeast concentration, alcohol was the most abundant compound (35.62%), followed by alkenes (30.61%), acids (20.94%), esters (6.64%), and others (6.18%). Silane contributed the most to the content of volatile compounds. Neopentyl alcohol, doconexent, and octamethyltrisiloxane were present in all samples, with neopentyl alcohol and doconexent contributing to fresh fruity notes (Hu *et al.* 2020).

Different yeast concentrations influence the major compounds in the wine. Alcohols and

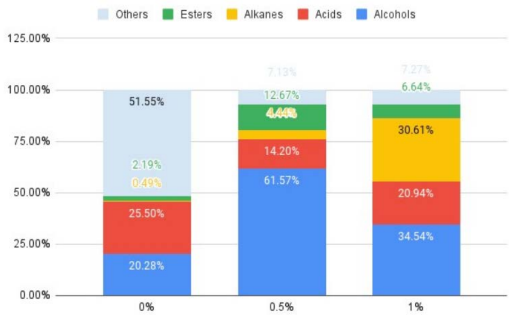

Figure 1. Volatile compound composition of black sapote wine based on GC analysis

esterd were high in the sample with 0.5% yeast concentration and alkenes were high in the sample with 1% yeast concentration, while acids were primarily found in the sample with 0% yeast concentration. The alcohols and aldehydes contained in the wine contribute to a leafy "herbaceous" and "solvent-like" odor (Liu *et al.* 2019).

CONCLUSION

The pH of black sapote wine varied as the variables varied. The sample with 0% yeast concentration showed a slight decrease, probably due to contamination, while the samples with 0.5% and 1% yeast concentration showed a significant decrease in pH values, influenced by acid production. Lower pH is preferred for the stability of polyphenols. Titratable acidity increased in the sample with 0.5% yeast concentration, indicating successful fermentation.

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DECLARATION OF CONFLICT OF INTERESTS

We declare no financial or non-financial conflicts of interest that may affect the impartiality of our study entitled "Analysis

of Physicochemical Properties and Volatile Compounds of Black Sapote Wine Produced with *Saccharomyces cerevisiae* Yeast".

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